

TABLE OF CONTENTS

10 TROUBLESHOOTING.....	2
OVERVIEW.....	2
TROUBLESHOOTING SYSTEM-LEVEL PROBLEMS	5
<i>General Site Housekeeping.....</i>	<i>5</i>
<i>Equipment Connections.....</i>	<i>5</i>
<i>Environmental Hazards Including Weather.....</i>	<i>6</i>
<i>Program Change Using the Same Satellite.....</i>	<i>8</i>
<i>Acquisition of a New Satellite.....</i>	<i>10</i>
<i>Loss of Signal during Operation.....</i>	<i>12</i>
<i>Problems with Program Outputs</i>	<i>13</i>
<i>Variations in System Configurations.....</i>	<i>14</i>
TROUBLESHOOTING SPECIFIC COMPONENTS.....	16
<i>ComStream ABR200 Audio Broadcast Receiver.....</i>	<i>16</i>
<i>Scientific Atlanta D9223 System Receiver.....</i>	<i>24</i>
<i>Pansat AP-3000 and AP-3000E Antenna Positioners.....</i>	<i>31</i>

10 Troubleshooting

Overview

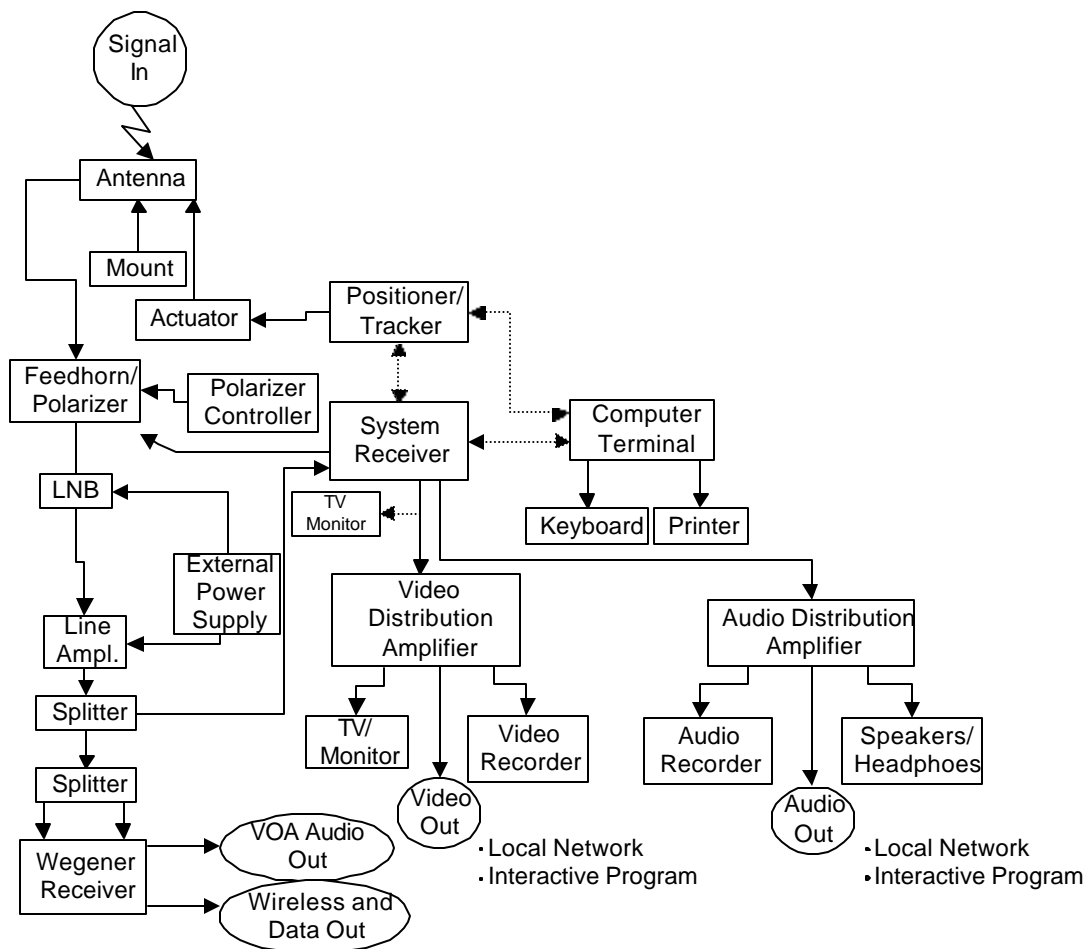
Troubleshooting at TVRO satellite receiving sites depends on the equipment that has been installed at the site. Troubleshooting sections for specific components of equipment have been included in the chapters for those components and are not reproduced here.

The principal troubleshooting task at any TVRO site is to isolate the cause of the problem to the system components responsible as quickly as possible. Then, by referring to the detailed troubleshooting section for those components, the problem can be evaluated further and a solution found. In general, the more widespread the problem, that is, the more system components that are affected, the closer the problem is to the signal source. It is important, therefore, always to determine the extent of the failure or malfunction. In this way, the problem may be isolated to specific system components, for example, a positioner, or a distribution amplifier.

The purpose of this chapter is to assist in isolating system problems to major system components. The most common system problems are analyzed for the probable system components responsible for the failure. It is then necessary to refer to the specific system component manual troubleshooting section for further detailed information on the problem.

A block functional diagram of a typical TVRO satellite receiving station is shown in Figure 10.1.

Figure 10.1, TVRO System Functional Components



Specific equipment varies from TVRO site to TVRO site. Because of this, some sites do not have connections between system components that other sites have. For example, in Figure 10.1, all system receivers are capable of providing direct current (DC) electrical power to the low-noise block down converter (LNB) on the antenna. A switch on the receiver usually controls this function. If the site supplies outside equipment with power from an external electrical generator, this function can be switched off at the receiver.

For satellite positioners, no connection to an external computer terminal is required; however, such control is necessary for the proper functioning of the two-axis trackers (for example, the Merrimac MS-1 Tracker). With the Pansat and Houston components, direct connection to the system receiver is not required. With the Pace and Manhattan components, direct connection is recommended by the manufacturer. With the Merrimac, direct connection is essential for proper signal tracking.

Individual sites also have great variation in the type and numbers of equipment connected to the video and audio output signals. This chapter cannot discuss troubleshooting for all possible combinations of these output devices; however, a few general problems are discussed. Many questions must be answered by reference to the specific equipment manuals at the sites.

Troubleshooting System-Level Problems

Some of the most common system-level problems encountered at TVRO receiving sites are discussed below.

General Site Housekeeping

Many TVRO sites operate infrequently and with limited staff. Over a period of time, problems begin to appear that are associated with causes such as:

- A change of staff personnel;
- Frequent disconnection and reconnection of system components (particularly recorders); and
- The disappearance of many individual equipment manuals.

As a general rule of good housekeeping, manuals of all system components must be kept in a single and well-known location. This should include everything from the antenna to the recorders. For certain major system components, this manual contains reference information, but it does not contain information on recording equipment that has been purchased locally by the individual TVRO site.

Once a site has been installed and connected properly, a detailed diagram of the system should be prepared. This diagram should identify all equipment, cable, and wire connections. Labels should be placed on all pieces of equipment, and tags or colors should be used to mark the cables and wires.

Good housekeeping, therefore, requires the following, as a minimum:

- A complete system connection diagram;
- Labels and tags on equipment as well as cables; and
- A dedicated and protected place for equipment manuals, including this one.

Equipment Connections

Because there are so many cable and wire connections in a typical TVRO receiving site, this one area should be among the first to be checked when a problem arises.

If some of the components are used for other purposes, for example, video or audiocassette recorders, they may not be reconnected correctly. Or, the cable connectors may deteriorate and fail because of repeated disconnection and reconnection.

Environmental Hazards Including Weather

The outside environment is a common cause of operational problems. The effects can be anything from signal degradation to total loss of signal. Simple obstruction of signal, mechanical failure, or electrical failure may be involved. Usually, the front-end system components are the ones affected, such as the antenna, antenna mount, actuator, LNB, polarizer, cabling, or line amplifier (if any). However, strong lightning strikes can burn out other equipment, such as the system receiver.

In addition to hazards at the receiving site, the satellite relaying the signal can be the source of poor signal or loss of signal. Twice each year, during the seasons of the spring and autumnal equinoxes, the satellite passes through the Earth's shadow once a day for a period of up to 72 minutes. These eclipses begin about 23 days before the actual equinox, reach their maximum duration at equinox, and continue to occur until 23 days after equinox. During each eclipse, the satellite must rely upon battery power to maintain service. This may result in degradation of transmitted signal power from the satellite. The received signal may degrade or cease altogether in marginal situations.

Also occurring during the seasons of the equinoxes is the passage of the satellite once a day *between* the Earth and the sun. These transits last for much shorter periods than the eclipses. A typical duration is about 10 minutes. They occur each day for about six days on either side of the equinoxes, depending on the latitude of the TVRO receiving station. During these events, called sun transit outages, the sun is such a source of noise that it completely overwhelms the satellite signal.

Table 10.1 provides a summary of several environmental and astronomical causes of signal loss.

TABLE 10.1, ENVIRONMENTAL AND ASTRONOMICAL SIGNAL LOSSES

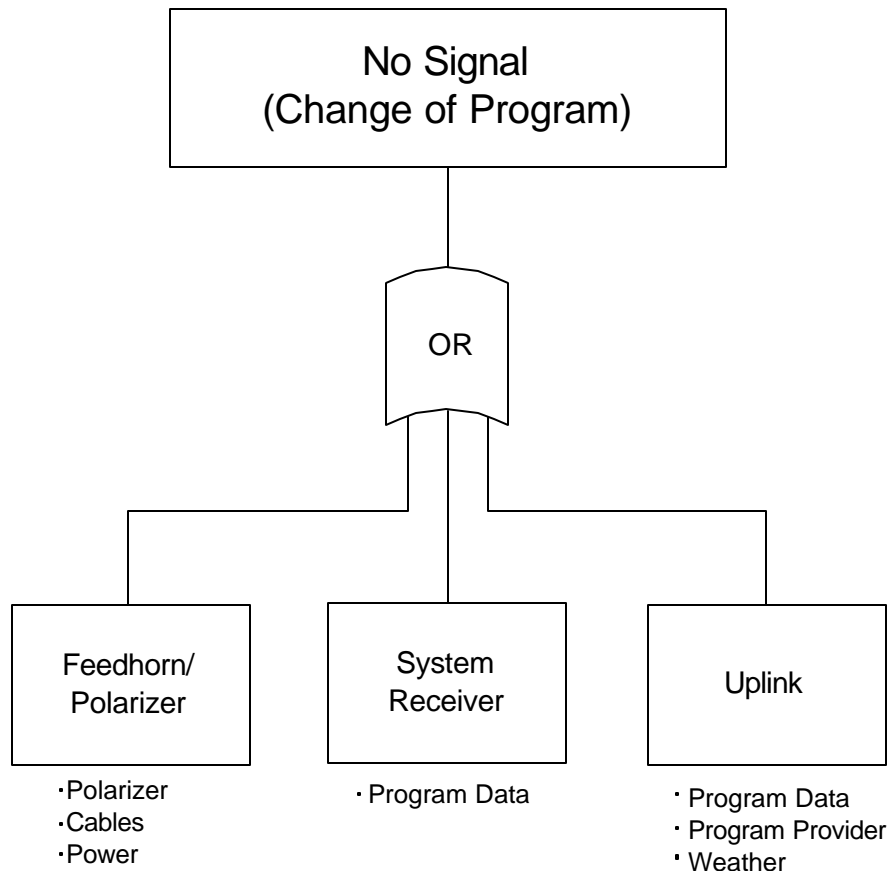
SOURCE	CAUSE	EFFECT
Lightening Strike	Electrical overload	Burnout of LNB, Polarizer, Line Amp, Splitter, System Receiver Damage to actuator, antenna mount
Wind	Dynamic antenna movement; mechanical distortion	Erratic signal fluctuations; position errors; antenna distortion/destruction
Dust	Actuator stiffness/failure Polarizer lock	Positioning failure; polarization adjustment failure
Rain	Seepage into LNB/cabling	Signal degradation or total loss
Heat/Cold	LNB local oscillator drift	Loss of AFC lock
Ice/Snow	Mechanical freeze up of polarizer/actuator Ice in feedhorn	Polarization adjustment failure; positioning failure Noisy signal/signal loss
Sunlight	Degradation of electrical insulation	Noisy signal/signal loss
Birds/Bees	Nesting in feedhorn	Signal degradation/signal loss

SOURCE	CAUSE	EFFECT
Animals	Gnawing electrical insulation	Noisy signal/signal loss
Construction	Damaged/severed cabling Damaged antenna/ antenna mount	Signal degradation/signal loss
Solar Outage	Excessive solar noise input	Signal overwhelmed by noise
Satellite Eclipse	Satellite transmission power reduction	Signal degradation/signal loss

Program Change Using the Same Satellite

Figure 10.2 shows the system components that might be the cause of a failure to acquire signal after a change to a new program from the same satellite.

Figure 10.2, Cause of Failure after a Program Change from the Same Satellite



Since the settings of the positioner/tracker and the antenna have not changed from the last program, they are not immediately suspect. System components that are suspect include:

- Feedhorn/Polarizer;
- System Receiver; and
- Uplink.

The following have not been changed and should not be affected since the last program selected, except for the polarizer, which might require readjustment to accept the polarization of the new program signal. It would be good procedure, however, to recheck these items to make sure that they are functioning properly.

- Feedhorn/polarizer;
- Cable connections; and
- Electrical power supply.

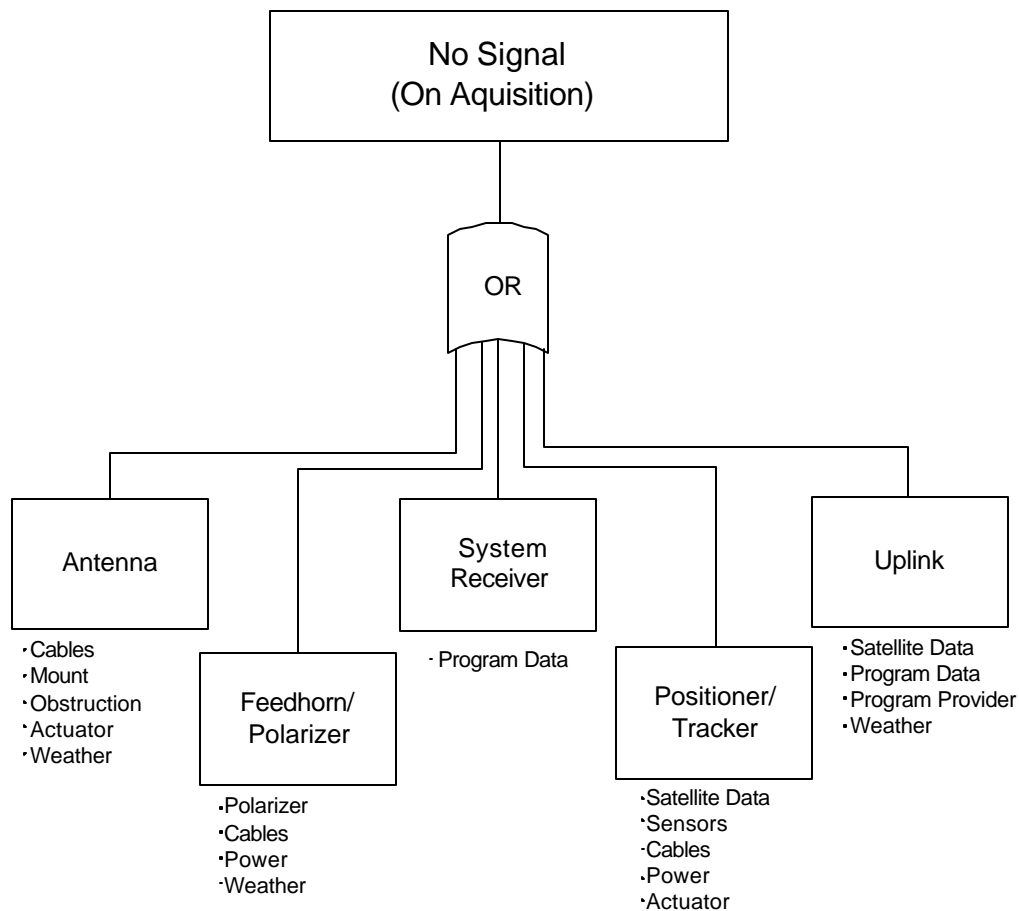
The system receiver may be the cause of the problem in several ways. Transmission data for the satellite program, such as signal band (C or Ku band), forward error correction (FEC), intermediate frequency (IF), polarization, program package identification (PID), symbol rate, video bandwidth, or video format may be incorrectly set. It may be necessary to download an updated PID for this satellite from the uplink site. Authorization to receive the new program should no longer be a cause of the problem, since the United States Information System (USIS) is not restricting its satellite broadcasts any longer.

Alternatively, the cause may be at the uplink. Program information described above for the system receiver may be incorrect or may have been changed. A different program generally means a different program provider. The source of the difficulty may be at the provider. Weather can be a problem at the uplink, as well as at the receiving site.

Acquisition of a New Satellite

When acquisition of a new program from another satellite fails, other system components may be the cause of failure in addition to those described above. Figure 10.3 shows the system components involved in this problem.

Figure 10.3, Cause of Failure after Acquisition of Signal from a New Satellite



The list of suspect components includes:

- Antenna;
- Feedhorn/Polarizer;
- System Receiver;
- Uplink; and
- Positioner/Tracker.

Because the antenna has been repositioned to acquire a new satellite, common causes of failure can be the cable connections at the LNB (located on the antenna

feedhorn) and the long cable connecting the antenna subsystems to the receiver. Although this long cable may connect first to line amplifiers or signal splitters, neither of these components is suspect in this case. Additional causes of failure can include a defective mount, actuator, or a possible obstruction blocking the signal from the new pointing direction.

Potential problems in the feedhorn/polarizer described in the case of acquisition of a program from the same satellite apply in this case, as well. In addition, whenever the antenna has changed position, cable connections at the LNB for signal or electrical power can fail.

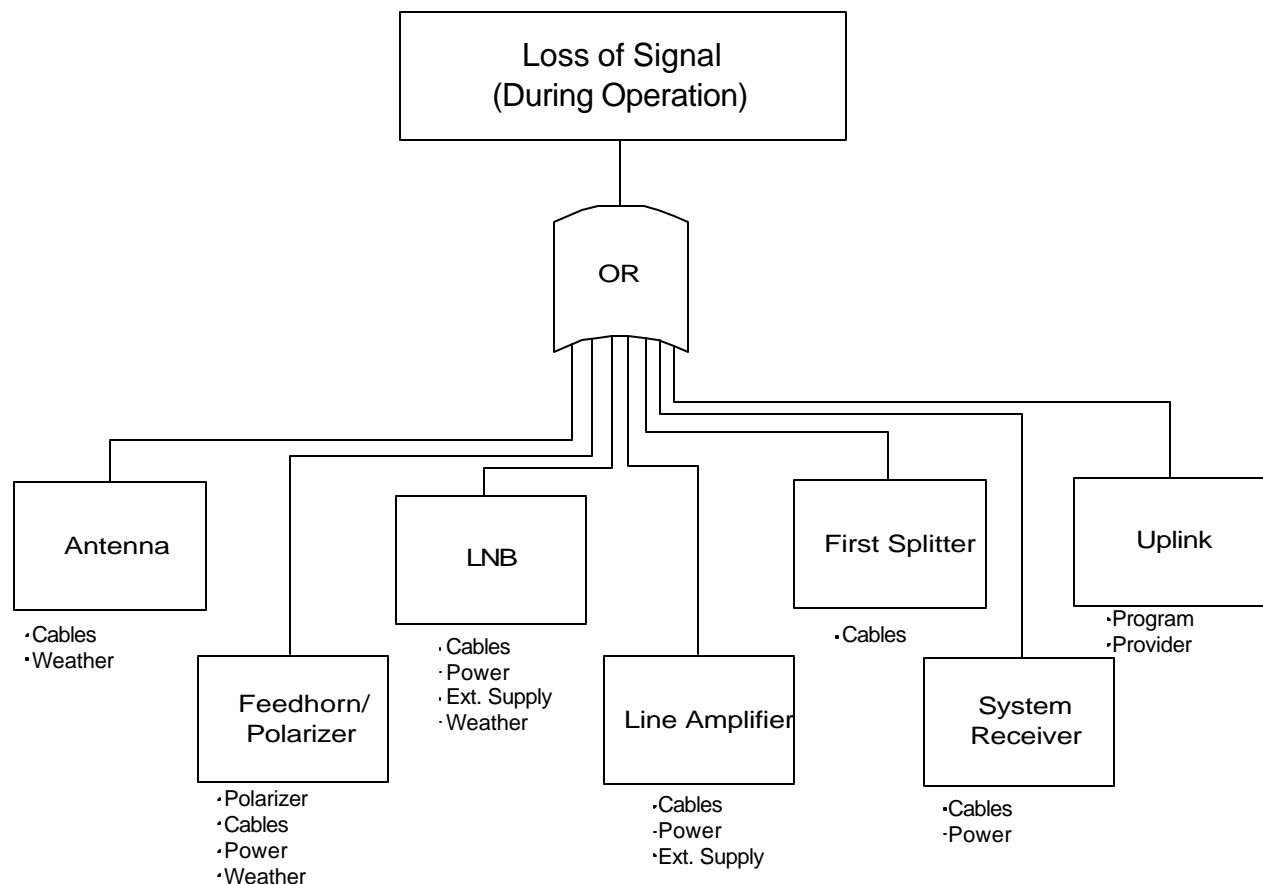
All of the possibilities associated with the system receiver and the uplink, outlined for the case of acquisition of a program from the same satellite apply in this case, as well.

The positioner/tracker could be the cause through failure of its position sensor at the antenna, or failure of the actuator to reposition the antenna properly. Additional causes might be the actuator motor connections or the electrical power supply to the actuator. It is also possible that the positioning data for the satellite is incorrect.

Loss of Signal during Operation

In this case, signal may degrade or be lost altogether. Digital signals tend to fail abruptly. The possible causes for this problem may be found in many system components. Figure 10.4 shows the suspect components.

Figure 10.4, Cause of Loss of Signal during Operation



The list of suspect components includes:

- Antenna;
- Feedhorn/Polarizer;
- LNB;
- Line Amplifier;
- First Splitter;
- System Receiver; and

- Uplink.

The most common sources for trouble in this case may be cable connections or electrical power. Weather changes can affect the antenna, feedhorn/polarizer, and the LNB. The source of signal problems may be at the uplink or with the program provider. Using system receiver parameter measurements, signal quality can be assessed. Degrading signal strength can be assessed by the bit error rate (BER). A drift in the IF resulting from electrical power fluctuations or temperature variations at the LNB can be assessed by the automatic frequency control (AFC) reading. The system component not expected to contribute to a failure in this situation is the positioner/tracker, since it has no active role to play.

Up until this point, the problems described would be expected to affect the total received signal. Both video and audio portions would be affected equally. This implies that the problem would be located:

- At the system receiver;
- Ahead of the system receiver; or
- In components that influence points ahead of the system receiver.

Problems with Program Outputs

Problems may arise in which either the video or the audio signal is good, but the other signal is distorted or absent. These problems usually involve the system receiver or components that accept outputs from the system receiver. Refer to Figure 10.1 for these kinds of components. Also, refer to the troubleshooting sections in an earlier chapter for the specific receiver installed at your site. In addition, problems with program outputs could originate at the signal source, and this possibility should not be overlooked.

Picture is good; Audio is distorted or absent.

In this situation, the video signal appears strong, but problems with the audio exist. There are a number of possible causes for this condition. To help isolate the cause, follow the steps below:

1. If the audio signal level indicator is off, then low signal strength may be the problem. Check with the uplink station.
2. If the audio signal level indicator is on, check external connections to the input port of the receiver to make sure that no electrical shorts or intermittent connections are present.

4

The first two steps apply only to receivers designed to receive audio signals only.

3. Check to make sure that the audio is not being muted by a receiver command.

4. Make sure that the proper connections are made to the audio output connectors. Recheck wiring connections to make sure of proper phasing. If the output feeds several pieces of equipment, disconnect the equipment and monitor the audio at the connector. If the problem disappears, then a wiring problem at external equipment exists. If the problems are present at the output connector, the receiver unit may need servicing.
5. If a distribution amplifier is not part of your system configuration, it may be necessary to operate your external equipment through a distribution amplifier.

Audio is good; Picture is missing

In this situation, the audio signal strength is good, but the video signal is missing. To isolate the problem, follow the steps below:

1. Make sure that the cable that runs from the LNB to the system receiver is not too long (some cable types have high losses). Cable runs of more than 100 meters require line amplifiers.
2. Make sure that the input signal to the system receiver has not been passed through several splitters (no more than three). Check that there are no missing terminations on the splitters, or low-quality splitters on the cable.
3. Check to see at what point the video signal is lost by disconnecting equipment from the TV monitor forward and checking the signal on an oscilloscope. Check the connectivity of the cables and the connectors with a multimeter. Alternatively, substitute equipment and cables known to be working properly.
4. If the video signal is used to operate many pieces of equipment through splitters, it may be necessary to connect them through a video distribution amplifier instead.
5. Check with the uplink station to see if the problem exists there.

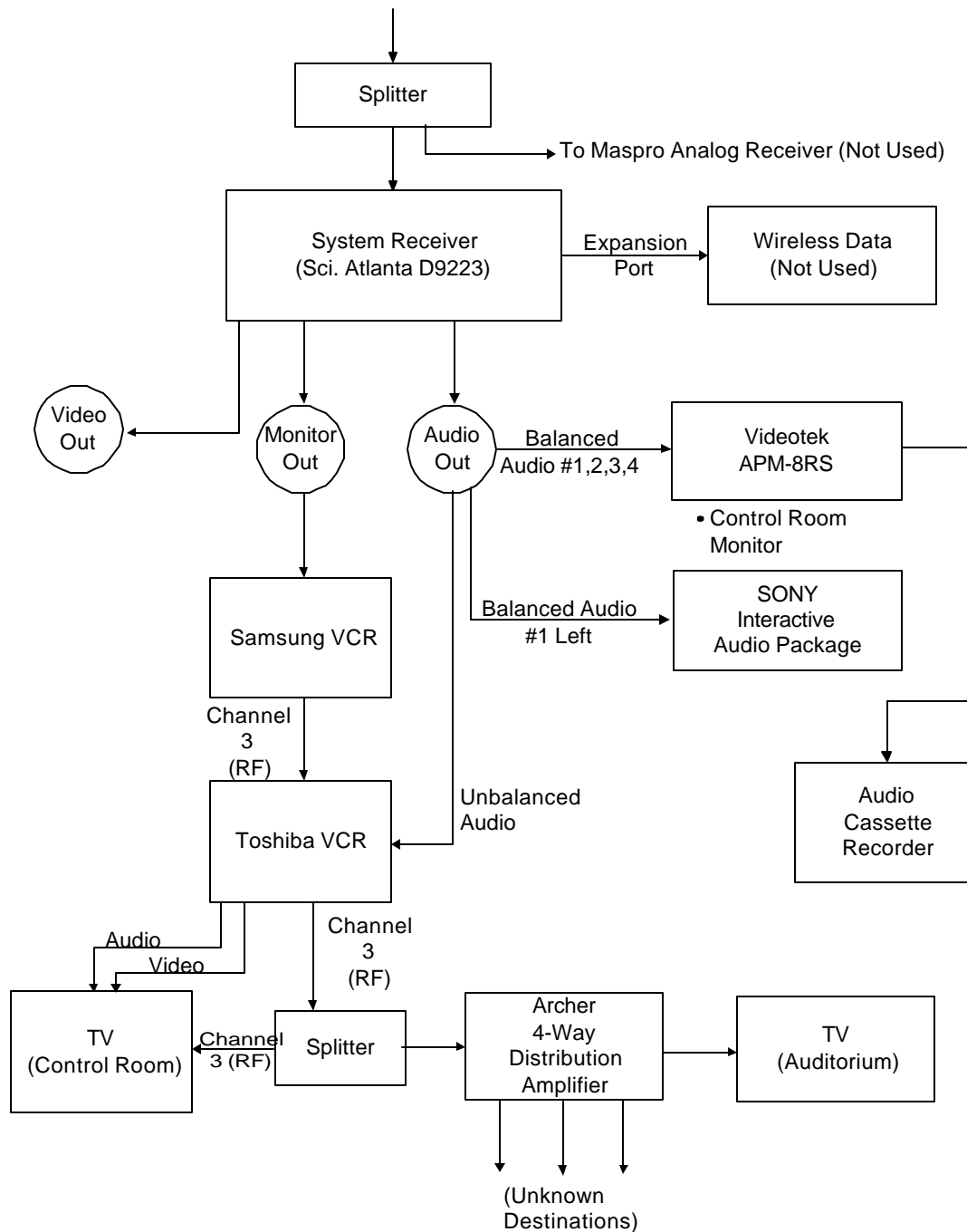
Sound and picture are good, but unrelated

In this situation, both the video and audio signals are strong, but they are not related to one another. For this case, it is important to contact the uplink station, because the problem originates there.

Variations in System Configurations

Figure 10.1 presented a typical receiving site system configuration, showing video and audio outputs connected through distribution amplifiers to several different types of output equipment. Much of this equipment may have been purchased locally by the individual receiving sites, and may have specific manuals for installation, operation, and troubleshooting. It is possible, however, for the output equipment to be connected very differently from that shown in Figure 10.1. Figure 10.5 illustrates how one receiving site connected its equipment to the system receiver.

Figure 10.5, Alternative Output Configuration



The input signal to the system receiver was split and part was routed (but not connected) to an analog receiver, while the other was connected to a digital receiver. Since analog signals were no longer available from the satellite, the analog receiver was of no further use.

The video output of the system receiver was not used. Instead, the monitor output was connected directly to a video cassette recorder (VCR), and the Channel 3 RF output of this VCR was connected to a second VCR. Also connected to the second VCR was unbalanced audio output from the receiver. These VCRs could be used to record programs or to direct their video and audio signals to TV monitors. One TV was located in the control room and a second, large-screen TV was located in an auditorium that was used for interactive programs. The auditorium TV was one of four outputs from a small distribution amplifier. The other three outputs were not traceable.

The audio outputs of the system receiver served three purposes:

- The unbalanced audio for the TV monitors mentioned above;
- Four balanced, monaural outputs connected to an audio distribution amplifier. This amplifier served as a control room signal monitor for all audio channels. It also provided a single stereo output to an audiocassette recorder; and
- A balanced audio output (#1, Left) connected to the input of the SONY Interactive Audio Package, to be used during interactive programs.

This configuration of output equipment served the needs of the particular site using it. It did so without the necessity for purchasing expensive, dedicated distribution equipment. However, there was one source of trouble at this site that surprised even a skilled technician.

Because of inactivity and frequent disconnection of VCR recorders for other purposes, the receiving site is often turned off. When the VCR units are turned back on, they automatically come on in VCR mode, not TV mode. This results in no video or audio program, even if the input signal is strong. A simple push of a button on the VCR can correct this, but if it has been forgotten, time is wasted in searching for the problem elsewhere.

It is possible that many TVRO sites have unusual equipment configurations, different from these. Site-specific problems may arise from these configurations that cannot be anticipated or discussed here.

Troubleshooting Specific Components

ComStream ABR200 Audio Broadcast Receiver

This troubleshooting section is provided to aid the user in isolating equipment problems and to suggest appropriate actions toward solving the problem. If a particular problem cannot be resolved after reviewing the following material, or if a ComStream equipment failure is suspected, then seek further assistance by contacting your system administrator.

Fault Condition Descriptions

A detailed description of each fault condition is provided here to aid in troubleshooting.

FL5 — AGC Range Fault

This fault indication means the input signal to the demodulator is less than -90 dBm or greater than -30 dBm (approximately).

FL6 — Bit Time Lock Fault

This fault indication means the demodulator bit-time loop has lost lock. The receiver output data is disabled when this fault occurs.

FL7 — Carrier Tracking Lock Fault

This fault indication means the demodulator carrier-tracking loop has lost lock. The receiver output data is disabled when this fault occurs.

FL8 — AGC Range Fault

This fault indication means the decoder output BER is greater than 10^{-2} (approximately).

FL9 — Acquisition Failure

This fault indication means the demodulator has completed a search of all frequencies out to the limits defined by the **B3** parameter, and was unable to acquire a carrier.

FL10 — Carrier Tracking Range Fault

This fault indication means the demodulator carrier tracking register has reached its maximum (or minimum) setting.

FL12 — Bit Time Range Fault

This fault indication means the demodulator bit-time accumulator has reached its maximum (or minimum) setting.

FL13 — Nonvolatile Memory Fault

This fault indication means one of the parameters in the demodulator nonvolatile memory may have become corrupted. If this indication occurs repeatedly, the nonvolatile memory is defective.

FL16 — Watchdog Timer Fault

This fault indication means the demodulator microprocessor fault timer has failed to reset. FL16 normally indicates a memory fault, meaning the unit may be operating in an undesirable manner. When this fault occurs, the system automatically resets.

FL17 — Audio PLL Lock Fault

This fault occurs when the narrow band phase lock loop (PLL) that operates the audio digital-to-analog converter is not locked. Usually this is caused when RF sync is not achieved. If this alarm occurs by itself and will not clear by switching power off and on again, the receiver should be returned for servicing.

FL18 — Audio Sync Fault

This fault indicates that the receiver decoder is not in synchronization with the audio encoder at the uplink. This condition normally occurs if RF sync is not achieved.

FL19 — DSP Watchdog Fault

This fault indicates that the DSP audio decoder is not functioning normally. If this fault persists, then the unit should be returned for servicing.

FL20 — DSP Bit Failure

This fault indicates that the DSP audio decoder built-in tests did not successfully pass during start up. If this fault persists, then the unit should be returned for servicing.

FL21, FL22, FL23 — External Alarm Monitoring

All three of these faults are caused from monitoring an external device that produces a TTL logic “low” on Sensor inputs 4, 5, and 6. These signals are on the relay control port pins 22, 23, and 24.

FL24 — Outdoor Unit Fault

This fault indicates that the LNB is not drawing power from the receiver. If the receiver is connected to another ABR unit, this is a normal condition. The front panel ODU Fault indicator tracks this fault condition.

FL25 — Eb/No Threshold Fault

This fault indicates that the measured RF signal level (Eb/No) has dropped below the level set by the ET command.

FL27 — EPROM Checksum Fault

This fault indicates that the main control processor memory has been corrupted and is not functioning normally. If this fault persists, then the unit should be returned for servicing.

FL28 — Software Download Failure

This fault indicates that a software download was not successful. The control processor operates from the EPROM while this fault is active. Once the download is successful, this fault automatically clears. While this fault is set, the IDU Fault indicator on the front panel blinks at a 1-second rate.

FL29 — Channel Change Fault

This fault occurs when a channel change has been attempted, but RF and audio synchronization on the new RF carrier has not been achieved within 5 seconds. Acquisition returns to the previous signal, and normal operation is restored once lock is achieved. The channel change may be initiated from any one of three sources:

- Local FS command;
- FS command from the uplink; and
- Remote (external) channel change (see LC command).

This is an abnormal condition and indicates that there may be a configuration error within the receiver, a mismatch with the actual RF carrier parameters, or that the RF carrier is not present.

FL30 — Control Channel ID Fault

This fault condition exists if the channel and network ID information is not received over the control channel every 5 seconds. Typically, this indicates that a problem exists at the uplink concerning the audio multiplexer. However, if other receivers in the network are not showing this alarm condition, then the unit may need servicing.

FL31 — Invalid Network ID

This fault occurs when the receiver achieves RF sync, but receives an invalid network/channel ID or no network/channel ID at all. This fault indicates that one or more of the following conditions are true:

- Receiver FD or CC commands are not set properly;
- The uplink is not transmitting a network/channel ID, or it is transmitting an invalid network/channel ID;
- There is a hardware problem with the audio decoder portion of the ABR receiver; and
- The receiver locked onto an adjacent audio carrier that is within its frequency search range, but it is not the carrier specified in the selected format definition.

Troubleshooting Diagnosis

In addition to the fault indications above, a number of symptoms may indicate problems that can be corrected. These symptoms and actions are described in Table 10.2.

TABLE 10.2, TROUBLESHOOTING SYMPTOMS AND ACTIONS

SYMPTOM	ACTION
Power indicator is not illuminated	<ul style="list-style-type: none"> - Make sure that unit is plugged into an active AC outlet - Verify that the line cord is firmly plugged into the rear panel receptacle - Make sure that the line cord is not at fault by using a cord that is known to be working <p><i>Note: If these do not solve the problem, this indicates a possible internal fuse failure. Do not attempt to repair!</i></p>
No sign-on message on RS-232 terminal after power up	<ul style="list-style-type: none"> - Make sure the power indicator is on - Check that the RS-232 cable is connected to the M&C port via the DB-9 to DB-25 adapter cable supplied with the receiver. A "straight-through" connection should be used. Verify the connection between pins 2 and 3 at both ends of the cable. Make sure that pin 4 (data terminal ready) is an active input into the receiver. - Check to see if the terminal is configured properly (default is 2400 baud, 7 data bits, 1 stop bit, odd parity)
Sign-on message is present, but typed commands are not displayed on the remote terminal	<ul style="list-style-type: none"> - Make sure that the command echo is enabled by typing EE <space> <cr> - Make sure of cable connections
ODU Fault indicator is illuminated	<ul style="list-style-type: none"> - This indicates that the LNB at the antenna is not drawing power from the receiver - If more than one receiver is connected together (daisy-chained), this indication is normal for those receivers not directly connected to the LNB. This indicator can be turned off using the OM command. - Make sure that the cable between the antenna and the receiver RF input is connected to the LNB at the antenna and to the RF IN connector at the receiver. - Make sure of the cable connectivity between the two connector ends. Use a multimeter to check for continuity after disconnecting the cable. Examine the connectors for proper assembly. - Replace the LNB. If the problem still persists, recheck cable, and then replace receiver.

SYMPTOM	ACTION
RF Sync indicator is not illuminated	<ul style="list-style-type: none"> - The RF signal is not being received properly. Audio Sync indicator should not be illuminated either. If the Audio Sync indicator is illuminated, the receiver unit needs servicing. - Check to see that the configuration parameters are correct for the application (FD, CC, FS) - Check the AGC level using the AG command. The value should be between 50 and 200 - Recheck installation. Refer to startup problems in <i>TVRO Installation Guide</i>.
Audio Sync indicator is not illuminated	<ul style="list-style-type: none"> - If "RF Sync" indicator is on, then the received signal strength may be too low for operation (that is, the "Signal" indicator is off). Investigate causes of low signal strength. If the "signal" indicator is on, or blinking, then the unit is receiving a good signal level. - Check with the uplink to make sure that the audio encoder unit is functioning properly. If it is, then the receiver may need servicing. If it is not, the problem is at the uplink.
Signal indicator is not illuminated	<ul style="list-style-type: none"> - This indicates that the received signal strength is below the value set by the Q0 command. If the signal is too weak, the "RF Sync" indicator is on. Check the signal strength using the EB ? command.
IDU Fault indicator is illuminated	<ul style="list-style-type: none"> - Connect a terminal to the M&C port on the rear panel of the receiver. Use the FL ? command to determine what type of faults are occurring. Follow the action descriptions associated with each type of fault.
IDU Fault indicator is blinking	<ul style="list-style-type: none"> - A software download attempt has not been successful. The receiver continues to operate out of EPROM memory. Once the software download has been successfully completed, this fault automatically clears.
RF and Audio Sync indicators are on, but no audio signal is present	<ul style="list-style-type: none"> - The receiver may not be authorized to output audio. Check the audio status, AS, to make sure that audio operation is permitted. If it is not, check with the uplink operator for audio authorization. - Check to make sure that the audio is not being muted by the M0 and M1 commands. - Make sure that the proper connections are made to the audio output (DB9 male) connector. Use the built-in audio tests (AT command) to generate audio tones. Monitor the audio output at the connector. If no tones are present, the unit may need servicing.

SYMPTOM	ACTION
Audio is present, but it is highly distorted	<ul style="list-style-type: none"> - If the signal level indicator is off, then low signal strength may be the problem. - If not, check external connections to the audio port to make sure that no electrical shorts or intermittent connections are present. - If the output feeds several pieces of equipment, disconnect the equipment and monitor the audio at the connector. If the problem disappears, then a wiring problem to external equipment exists. It may be necessary to operate the external equipment through a distribution amplifier.
Audio is present, but unusually high background noise is also present	<ul style="list-style-type: none"> - If you are operating in a joint stereo mode, a high background (common mode) noise indicates that there is a phase reversal at the encoder's audio inputs. Recheck the encoder wiring to make sure that the input leads (+) and (-) for both channels are properly connected. - Recheck wiring connections at the output of the receiver to make sure of proper phasing.
Audio is present, but the volume is low	<ul style="list-style-type: none"> - Make sure that connections are made to both signal polarities (+) and (-). When operating with a single connection, the output level is reduced 6 dB below the output level for balanced operation.
RF and Audio Sync are achieved, but there is no data output	<ul style="list-style-type: none"> - The receiver may not be authorized to output data. Using the FD command, check the receiver authorization setting for the current format. Make sure that data operation is permitted. If it is not, check with the uplink operator for proper authorization. - Make sure that the proper connections are made to the data port output connector (DB25 female). Make sure that the interconnecting cable is properly wired ("straight-through"). - Make sure that the external DTE equipment and data port setup parameters match (same baud rate, stop characters, parity, etc.). - Use the built-in data test (X1 command) to generate data text to the printer. If data output is still not observed, seek assistance from your system administrator.

SYMPTOM	ACTION
<p>RF and Audio Sync are achieved, but there is no relay closure operation</p>	<ul style="list-style-type: none"> - Make sure that the CO ? command displays the result "CO XXXXXXXX". If a 1 or 0 appears, then the cue signal from the uplink cannot be processed properly. Enter "CO <space> XXXXXXXX". - The receiver may not be authorized for relay operation. Check the receiver authorization setting using the FD command. Make sure that relay operation is permitted. If it is not, check with the uplink operator for proper authorization. - Make sure that the proper connections are made to the relay/control port connector (DB25 male), and that the interconnecting cable is properly wired. <p>Use the built-in relay test (CO command) to activate and deactivate the relay closures individually. Monitor the contact closure at the connector with a multimeter. This method eliminates any misconnections. If proper operation is still not observed, contact your system administrator.</p>

Scientific Atlanta D9223 System Receiver

Types of Signal Interference

Types of terrestrial interference known to cause problems with digital compression signals are out-of-band interference such as aircraft radar altimeters, commercial microwave ovens, and/or in-band interference from hand-held electrical or combustion engine equipment operated near the receive antenna.

Adjacent-band radar altimeter interference

Aircraft radar altimeters do not operate in the 3.7 to 4.2 GHz band, but are close enough in frequency that they can produce interference strong enough to saturate the LNB and/or receiver.

Radar altimeter interference can be eliminated by installing an off-the-shelf microwave filter designed specifically for out-of-band signals. These microwave filters are installed between the feed assembly of the antenna and the LNB.

Industrial/microwave equipment interference

This form of microwave interference typically originates from industrial microwave ovens operated in factories and commercial sites, and interferes primarily with transponder #24. Microwave signal levels produced by these sources can be high enough to saturate the LNB and/or receiver. Generally, replacement of the offending Magnetron RF output tube will solve this problem.

Ignition noise interference

Ignition noise interference is typically broadband in nature and can interfere with the received signal. Ignition noise can be generated by faulty combustion engine ignition systems, hand-held electric dryers/blowers, or other electromagnetic equipment operated near the receive antenna. In most cases, the noise energy within the received channel can be tolerated, provided that receive/line amplifiers do not become saturated.

A signal input level of approximately -50 dBm is recommended for normal receiver operation. This allows sufficient receiver signal increases so that any interference that takes place within the 3.7 to 4.2 GHz band (as well as adjacent bands) does not cause the receiver to become saturated. If other parts of the receive system become saturated, steps should be taken to eliminate the unwanted interference.

Ignition noise can be reduced or eliminated by restricting the use of combustion engines, hand-held electric dryers/blowers, or other electromagnetic equipment near the receive antenna.

Minimizing Signal Interference

Specific actions you can take to minimize the effects of local terrestrial interference are discussed in the following subsections.

Adequate signal level maintenance

The input signal level as provided to the receiver from the satellite LNB should be maintained between the values of 20 to 50 as displayed on-screen at the Installer menu.

Signal saturation avoidance

If signal saturation is a problem, the LNB may require a attenuator installed before the receiver. Signal attenuation between approximately 6 to 20 dB can effectively reduce or eliminate the effects of signal saturation.

Signal levels should range from 20 to 40 for the lower power type carriers (<10Msymbols/s), and from 30 to 50 for larger, high power carriers; especially those which occupy a full transponder. Low signal levels accompanied by a high Bit Error Rate usually indicate excessive signal loss between the receiver and the antenna. High signal levels accompanied by a high Bit Error Rate usually indicate signal overloading at the receiver and/or line amplifier RF input.

Local Oscillator stability

To minimize the time required for synchronizing to a target carrier frequency, operate with a LNB having the LO frequency stability given in Table 10.3.

TABLE 10.3, LNB LOCAL OSCILLATOR STABILITY VS. CARRIER SYMBOL RATE

Symbol Rate	LNB LO Stability
> 3 MS/s and ≤ 6 MS/s	± 1.0 MHz
> 6 MS/s	± 1.5 MHz

Line amplifier, isolator, and filter use

If you are using line amplifiers as part of your equipment installation, avoid saturating the line amplifier or overloading the receiver by locating the line amplifier at the appropriate distance from the LNB. Line amplifiers typically offer a gain of 20 dB, and should only be installed if the signal input cable length is approximately 50 to 100 meters.

The line amplifier used must be able to amplify the composite power of all the satellite transponders without distortion. An output 1 dB compression point of 0 to 10 dBm is usually sufficient in most cases. If installed, line amplifiers with noise figures under 7 dB provide the best signal-to noise ratio.

Antenna cross-polarization isolation should always be checked at the downlink. A misaligned LNB can introduce interference from other satellite signals.

If you are experiencing interference causing LNB overload from a radar signal existing outside the normal 3.7 to 4.2 GHz C-Band, a C-Band "block filter" can be installed before the LNB input. If installed, this type of filter can effectively reduce out-of-band interference and the effects of downlink path compression, and should not exceed 0.3 dB signal loss.

Be sure to terminate all splitter outputs, power dividers, and unused connectors, where necessary. Signal cables used should be low loss RG-11, with L-Band or equivalent rating.

Terrestrial in-band and out-of-band interference

The received signal level can be weakened and degraded because of local Terrestrial Interference (TI) originating from Earth-based, C-Band signal sources. Higher frequency Ku-Band signals are not affected by this type of interference. Both in-band and out-of-band local TI can adversely affect receiver operation.

Local, in-band interference that affects certain channels only is often caused by the antenna being located in or adjacent to the path of a microwave telecommunication signal tower. This source of interference can usually be identified with spectrum analyzer equipment. C-Band radar scatter originating from airport control towers can intermittently overload the LNB, and can be difficult to detect. The most common form of in-band interference is caused by noise spikes from electrical power or ignition systems, which are amplified by active components on the LNB and receiver. For this and other reasons, over-amplification of the LNB output signal can adversely affect the received digital signal. If local, in-band interference is present, installing a 10 dB C-Band attenuator pad at the input of the LNB will prevent signal saturation and compression.

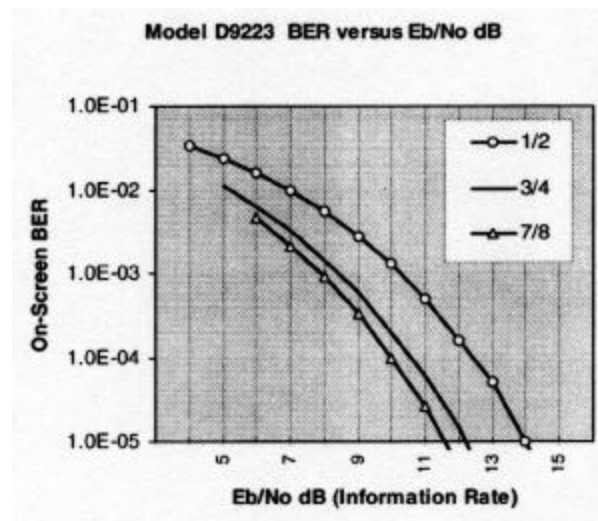
4	Some types of two-way radios or walkie-talkies can destructively interfere with a receiver because they use identical bands within the receiver IF frequency. Use of walkie-talkies should be restricted in the vicinity of the receiver.
---	---

Out-of-band interference can originate from a variety of sources. Aircraft radar altimeters are a common problem near airports. Commercial microwave ovens operating adjacent to TVRO station antennas have been known to interfere with digital compression signals. Installation of a C-Band bandpass filter before the LNB is recommended where there are known out-of-band interfering sources.

High Bit Error Rates

The Bit Error Rate (BER) associated with the received digital signal is extremely important, as it indicates how much of the received signal information contains errors caused by electrical noise/interference that must be corrected. The BER is displayed in scientific notation. For example, a received signal BER of 1E-5 (or 1.0×10^{-5}) is less than a signal BER of 2E-3 (or 2.0×10^{-3}). Figure 10.6 shows typical signal quality (BER) values obtained for various FEC rates as displayed on-screen at the Installer menu.

Figure 10.6, BER vs. Information Rate (typical)



The E_b/N_0 (Information Rate) is normalized as the energy-per-bit for a 1 Hz noise bandwidth, and applies to any data rate. The Information Rate is the useful data rate following Forward Error Correction (FEC), as defined by the DVB standard. The threshold for E_b/N_0 depends on the Viterbi FEC rate associated with the uplink signal. Table 10.4 lists the threshold E_b/N_0 for each of the available FEC rates.

TABLE 10.4, FEC RATE AND CORRESPONDING THRESHOLD E_b/N_0

FEC	Threshold E_b/N_0 (dB) (based on information rate)
1/2	4.5
2/3	5.0
3/4	5.5
5/6	6.0
7/8	6.4

For example, if the receiver is operating at 3/4 FEC, look at the middle curve in Figure 10.6. If the displayed BER is near $1E-2$, this corresponds to a E_b/N_0 of 5.5 dB (threshold). Below this threshold the video display is likely to break up, or signal synchronization can be lost. If the displayed BER is $1E-4$, the receiver is operating at a E_b/N_0 of 10.5 dB, which is approximately 5 dB over the threshold. If the received downlink signal is Ku (that is, clear sky conditions), the displayed BER may be approximately $1E-4$. With heavy precipitation, the BER is likely to increase to $1E-2$, corresponding to a loss of 5 dB. The 1/2 FEC rate threshold corresponds to a BER of $3E-2$, and the 7/8 FEC threshold to a BER of $3E-3$.

The BER threshold for the Model D9223 receiver ranges from 5E-3 to 2E-2, depending on the FEC rate setting used. For example, the BER threshold for a FEC rate of 1/2 is 2E-2, 1E-2 for 3/4, and 5E-3 for 7/8. For safe operation, the BER associated with the received signal should be at least 1/10th of the threshold (that is, for a FEC rate of 3/4, a BER of from 1E-3 to 1E-5 is considered ideal).

The received signal level can be weakened and degraded from precipitation (rain, ice, and snow) and from snow accumulation on the satellite antenna. Using the BER display is the best method for accurate antenna peaking. Common problems associated with a high BER are:

- Unterminated splitter port;
- Poor cabling or impedance mismatch;
- Marginal RF downlink signal level;
- Cross polarization; and
- Improperly pointed satellite antenna.

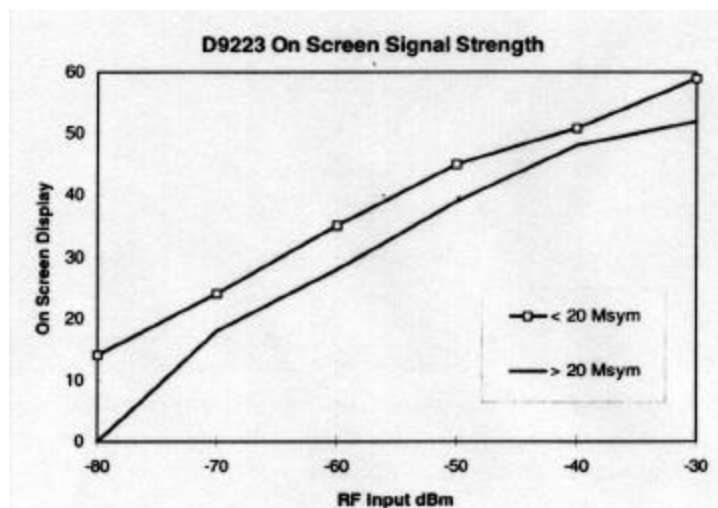
If no improvement in the BER is obtained after investigating these possibilities, faulty antenna or LNB equipment may be responsible for the problem. BER problems caused by low signal levels can be effectively improved by one or more of the following actions:

- Using higher-quality cable and connectors;
- Reducing the number of signal splitters and/or line amplifiers;
- Replacing the low gain LNB, if found to be faulty; and
- Installation of a line amplifier after a long cable run.

High BER caused by a high signal level

Figure 10.7 shows typical Signal Level values obtained for Symbol Rates above and below 20 <Symbols/s, as displayed on-screen at the Installer menu.

Figure 10.7, Signal Level vs. RF Signal Input



4

Displayed Signal Level values appear slightly higher for Symbol Rates below 20 MS/s than for Symbol Rates above 20 MS/s.

To reduce the possibility of tuner overload and the signal quality degradation that would result, the maximum RF signal input to the receiver is limited to -30 dBm for a full transponder RF carrier. A RF carrier of 3MS/s is a narrower bandwidth, and will carry approximately 10 dB less power than a full transponder RF carrier of 30MS/s.

For a Symbol Rate of 3.0 MS/s, the maximum RF input to the tuner should be -40 dBm, assuming that other full transponder (-30 dBm) signals may also be present at the tuner input. If sufficient cable/distribution loss exists between the LNB and the receiver, then the RF signal level will be significantly reduced, and the overall signal quality will be further degraded by the receiver tuner noise figure.

∫

If the displayed Symbol Rate is 30 MS/s, a Signal Level of 50 corresponds to approximately -30 dBm maximum RF input for this carrier. Similarly, a Signal Level of 25 corresponds to approximately -65 dBm RF input. Normally, the receiver would be operated somewhere between these two extremes.

A 10 dB attenuator pad installed before the receiver RF input (external LNB power switch set to OFF) can determine if the high BER is being caused by an unusually high signal level. Also, powering the LNB from a separate receiver/decoder using a splitter connection can assist in determining if the BER

problem is being caused by the input signal level. If, after taking these steps, there is no marked improvement in BER, the problem is likely in the satellite antenna or the LNB. A LNB operating with an unstable or noisy local oscillator can adversely affect receiver performance.

Diagnostics Guide

Many reception problems are due to incorrect or deteriorated electrical conditions and improper antenna orientation. These items should be checked first, and if a problem still exists, the guide in Table 10.5 may provide a solution to some common problems. If the problem still persists after consulting the diagnostics guide below, contact your system administrator.

4	Temporary, solar-related electromagnetic disturbances occur every year during the spring and autumn months. These disturbances usually persist for several minutes a day for approximately one week during these periods. For more information on solar outages, see Chapter 9, Standard Maintenance Procedures.
----------	--

TABLE 10.5, DIAGNOSTICS GUIDE

SYMPTOM	CAUSE	SOLUTION
Front panel displays “•”	Receiver is OFF (on stand-by)	- Press STANDBY button on the front panel to activate the receiver
Front panel is off	Receiver is unplugged or AC power is interrupted	- Check the AC power cord and electrical outlet.
No signal Signal Level <20	No DC power supplied to LNB	- Check external LNB DC power source (if using an external power supply), or verify that LNB power switch (receiver rear panel) is set to ON (if using internal power supply in receiver)
	Faulty LNB or cable Connection	- Check cable. Measure the LNB power output voltage. It should be +13V or +19V DC $\pm 10\%$ - Check that LNB cable does not exceed maximum length, and/or that signal splitters do not have missing terminations, which can cause excessive signal loss
No signal Signal Level >20	Incorrect receiver settings Incorrect LNB polarity	- Check RF frequency and other front panel/menu setup options - Verify/connect proper LNB polarity - Contact your dealer/reseller or local service provider for assistance

SYMPTOM	CAUSE	SOLUTION
	Incorrect antenna orientation	- Aim antenna for peak reception according to manufacturer's instructions (use a standard analog receiver tuned to a NTSC or PAL signal to confirm correct antenna position)
	Line-of-sight obstruction	- Relocate antenna or remove obstruction
Signal with high BER Signal level >20	Receiver has synchronized to a digital signal, but the signal is weak and the error rate is very high.	- Check antenna orientation. Use an analog receiver tuned to a PAL or NTSC signal to peak the antenna signal by minimizing white and black dots - Check that cable run from LNB to receiver is not too long (some cable types have high losses) - Check that cable does not have multiple (more than three) splits
Signal with high BER Signal level > 50	Signal too strong because line amplifiers installed after LNB	- Remove extra amplifier(s) and and/or add signal attenuator pads
No video or audio Signal LED is flashing	Receiver is tuned to a digital signal, but is not authorized for the service currently on transmission	- Check with your distributor to see if you are authorized to receive the service
Receiver does not accept input on front panel keypad	Front panel buttons are disabled by Lock Level setting	- Lock level is set to Loc3 or Loc4. Check setting and if Lock Level 3, set to level required

4	If no authorized service(s) is received, the cause may be due to poor signal strength, a distorted signal, improper installation, or equipment failure. Note that an antenna cannot be peaked by observing white and black dots in the video from a digital signal. If the signal strength is adequate, the video appears perfect. Likewise, if the signal strength is below threshold, no video is displayed at all.
---	---

Pansat AP-3000 and AP-3000E Antenna Positioners

Trouble-shooting the Pansat AP-3000 and AP-3000E antenna positioners involves interpreting error displays on the front panel of the positioner. Table 10.6 summarizes these error displays:

TABLE 10.6, TROUBLESHOOTING THE PANSAT AP-3000 POSITIONERS

SYMPTOM	SOLUTION
AE (Actuator Error) displayed	<ul style="list-style-type: none"> - Check connection of the two motor wires. - Make sure the gauge of the motor wires is not too small (14 gauge motor wires are recommended). - Check operation of actuator motor.
DE (Data Error) displays intermittently	<ul style="list-style-type: none"> - Check to see if unwanted or unauthorized movement of the antenna is occurring.
DE displayed continuously	<ul style="list-style-type: none"> - If positioner serial number is less than 4000, unplug AC power and replug again to clear display. - Check reed sensor (if applicable). - Check distance between magnet and reed sensor. - Check for loose or open connection of either sensor wire. - Make sure pulse and ground sensor wires are not touching each other. - Make sure sensor wire gauge is adequate (20 gauge shielded is recommended). - Check tightness of connection at terminal at rear panel of positioner. - Positioner control may be defective. Contact your system administrator.